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Michigan Public Domain Commission

Report to the Michigan legislature on the...

Lansing, Mich.

1915

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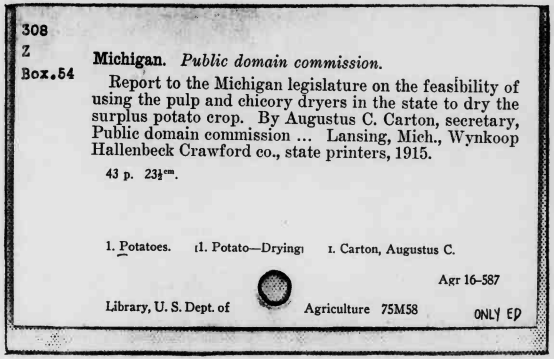

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Michigan. *Public domain commission.*

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REPORT

TO THE

MICHIGAN LEGISLATURE

ON THE FEASIBILITY OF USING THE PULP AND CHICORY DRYERS IN THE STATE TO DRY THE SURPLUS POTATO CROP

By
AUGUSTUS C. CARTON
Secretary
Public Domain Commission

LANSING, MICHIGAN
WYNKOOP HALLENBECK CRAWFORD CO., STATE PRINTERS
1915.

REPORT.

Hon. C. W. Smith, Speaker, House of Representatives,
Lansing, Michigan.

Sir: In compliance with House concurrent resolution No. 15, requesting the Secretary of the Public Domain Commission to take immediate steps to ascertain the commercial possibilities of dried potatoes, or potato flour, in the domestic and foreign market, and the utilization of the pulp dryers in the beet sugar and chicory factories to the benefit of Michigan industries, and make a report to the Legislature of his findings, I have the honor to submit the following report as Secretary of the Public Domain Commission:

INVESTIGATION.

In starting the inquiry in accordance with the above resolution, the investigation was made along five lines:

1st, Is the Michigan potato of enough food value to warrant the expense of drying it in any form or manufacturing it into potato flour?

2nd, Is it feasible to use the dryers at present used in the Michigan beet sugar and chicory factories for the drying of potatoes?

3rd, Is the demand, either for home consumption or foreign shipment, sufficient to warrant the beet sugar and chicory factories of this State in utilizing their dryers for the purpose named in the resolution?

4th, If the pulp dryers in the beet sugar and chicory factories of the State can be used for the drying of potatoes can the same be done at a profit, and still allow the farmer a fair price per bushel for his potato crop?

5th, With what other food stuffs would dried potatoes have to compete, and at what price would potato flour or dried potatoes have to be produced in order to sell in competition with other food stuffs?

It might be well to state at the outset that not only were such authorities consulted as were thought to be able to furnish reliable information on the subject, but the matter was taken up both by letter and telegraph with the managers of all the beet sugar and chicory factories in Michigan, and with the managers of the two factories in Michigan now producing dried potato products. One of these factories is situated in Casnovia, Muskegon County, and the other in Mayville, Tuscola County. I have also made inquiry through the Department of Commerce, Bureau of Foreign and Domestic Commerce, at Washington, D. C.; Department of Agriculture, Washington; Commission for Relief in Belgium; The Rockefeller Foundation; Michigan Agricultural College, and the American Red Cross Association, with headquarters in Washington, D. C. I have also corresponded with William O. Emory, now located in Detroit, but who at one time with his father operated a factory in East Tawas,

which dried potatoes and manufactured the same into flour. The matter of proper machinery to prepare the potatoes for the dryers, has been taken up with Jackson & Church, of Saginaw; Ruggles-Coles Engineering Company, 50 Church Street, New York City; The F. D. Cummer & Son Company, Cleveland, Ohio; Buffalo Foundry & Machine Company, Buffalo, N. Y.; and E. Salich & Co., Consulting and Constructing Engineers, 1602 Monadnock Building, Chicago, Ill. Extracts have been taken from a report of the Michigan Dairy and Food Department, the Rural New Yorker, of New York City, and several Consular and Trade Reports.

Whether the potato, which was first cultivated in Peru early in the sixteenth century, was discovered by the Spaniards or the English is not generally known, and so far as this investigation is concerned is of little moment. The fact, however, seems to be settled that in 1585 or 1586 potato tubers were brought from what is now North Carolina to Ireland on the return of the colonists sent out by Sir Walter Raleigh, and were cultivated on Sir Walter's estate near Cork. Like all other new food products, it had its enemies and for many years was not looked upon with much favor as an article of food. Years of cultivation and proper selection, so as to produce varieties that would contain ingredients necessary to make them desirable for food, have accomplished much and placed the potato in an enviable position among food products of this country. The following excerpt from a report of the Michigan Dairy and Food Department gives us a good idea of the value of the potato as an article of food:

THE POTATO AS A FOOD.

"The potato is truly a most remarkable product. It contains within its aseptic covering a rich store of one of the most easily digestible of all forms of starch. The observations of Mosse, Van Noorden and others have shown most conclusively that the starch of the potato is more easily digested and appropriated by the body than the starches of wheat, corn and most other cereals. In laboratory tests made by the writer it was found that potato starch digested in less than one-sixth of the time of cereal starches. The experience of hundreds of physicians in the treatment of diabetes has shown that in many cases the starch of the potato is more easily assimilated or better utilized than other forms of starch.

"Potato gruel made from specially prepared potato meal or the pulp of baked potatoes has been found in Germany of very great service in the feeding of infants and invalids. Potato starch is far better for this purpose than cornstarch, arrowroot and similar substances, which are pure starch and cannot be properly considered as foods. The long continued use of these starches in the feeding of young infants often results more disastrously.

"The potato is not only an easily digestible foodstuff but possesses much higher nutritive value than is generally supposed. According to Gautier, about one-fourth of the weight of the potato is food substance, consisting chiefly (nine-elevenths) of starch. Of the remainder, three-fifths are protein, the tissue-building element, and two-fifths alkaline

salts in combination with citric and malic acids, the acids of the lemon and the apple.

"From a dietetic standpoint, the potato is perhaps slightly deficient in protein, though this statement would be disputed by some physiologists whose experiments appear to demonstrate that the amount of protein contained in the potato is quite sufficient for ordinary bodily needs.

"The potato is certainly deficient in fats, of which it contains almost none, because of the fact that it is not, like so many of our vegetable foods, a seed, but a curiously modified and enormously fleshy tuber. This deficiency in fat must always be remembered in the use of the potato, and the lack must be made up by the addition of cream, butter, or some other foodstuff rich in fat.

"What the potato lacks in fat and protein, however, it makes up in salts, which constitute nearly 5 per cent of its dry substance and are perhaps its most characteristic quality from a dietetic standpoint and one of its chief excellences. These salts consist chiefly of potash, and in the ordinary form in which they are supplied do a most important service in maintaining the alkaline condition of the blood, which is essential to good health and resistance to disease. Meats contain very great excess of acid-forming elements and tend to acidify the blood. Cereals have some tendency in the same direction. The lowering of the alkalinity of the blood by acid-forming foods, especially by the free use of meats, is unquestionably one of the chief causes of the rapid increase in chronic diseases, the mortality from which has doubled within thirty years, causing a loss annually of 350,000 more lives than would occur if the average citizen was as healthy as he was thirty years ago. This is probably also one of the chief causes of arterio-sclerosis, or hardening of the arteries, gout, rheumatism, Bright's disease, apoplexy, and other degenerative maladies. The alkaline salts of vegetables are needed to balance the dietary. If the consumption of potatoes in this country could be quadrupled, the result would undoubtedly be the saving of many thousands of lives annually and an incalculable amount of suffering from disease.

"The great nutritive value of the potato, notwithstanding the fact that it is three-fourths water, may be best shown by comparing it with other known foods. A study of the nutritive value of various common foodstuffs shows that one pound of baked potato is equivalent in total nutritive value to the quantities of various foods shown in the following table:

Food equivalent in total food value to one pound of baked potato:
1⅝ pounds of boiled potato.
5⅞ ounces boiled beef.
1 pound chicken.
1½ pounds of codfish.
2¼ pints of oysters (solids).
4 pints of clams (in shell).
4½ pints of beef juice.
10 pints bouillon or beef tea.
1⅛ pints whole milk.
3 pints skimmed milk.
8 eggs.

9 ounces baked beans.
7 ounces bread.
1¾ pints oatmeal or cornmeal mush.
1⅓ pints hominy (cooked).
1 pint boiled rice.
1 pound of bananas.
2 pounds parsnips (cooked).
1 pound green peas (cooked).
3 pounds beets (cooked).
4 pounds boiled cabbage.
4 pounds radishes.
5 pounds tomatoes.
5 pounds turnips (cooked).
6½ pounds cucumbers.

"From the above table it will readily appear that the potato is one of the most nourishing of our common foods. Its value is still further emphasized by the fact that steamed or mashed potato digests in two or three hours, whereas roast beef requires four or five hours, or double the time (Gautier).

"Bunge, the world's greatest authority on the chemistry of foods, has called special attention to the importance of the alkaline salts that are found in vegetables, and in a much larger proportion in the potato than in any other vegetable used as food, the potato containing nearly forty times as much of this useful element as some cereal foods. No farmer would think of feeding his horses or cattle on grain alone. Cereals of all sorts contain a considerable excess of acid-forming elements. Grass and herbage of all sorts, as well as fresh vegetables, contain an abundance of alkaline salts, and hence are a necessary part of the diet of animals. Human beings, as Bunge has clearly shown, require such vegetables for the same reason, and the potato is the most valuable of all known foods as a source of these essential elements. This is perhaps the reason why the potato is an almost invariable accompaniment of meat dishes. Meat contains an enormous excess of acid-forming substances, which are to some extent neutralized and antidoted by the basic salts of the potato.

PURCHASING POWER OF A DOLLAR EXPRESSED IN NUTRITIVE VALUES.

	Cost price April 22, 1914, at Lansing.	Cost price per pound.	Calories per pound.	Calories $1.00 will purchase.	Per cent. protein.	Protein $1.00 will purchase.	
						Pounds.	Ounces.
Navy bean, dry	$0.07 per lb.	$0.07	1,600	25,700	22.5	3	3.4
Milk	0.08 per qt.	0.38	310	8,200	3.3		14
Eggs	0.30 per doz.	0.17	700	4,080	14.8		14
Cheese	0.25 per lb.	0.25	1,950	7,800	25.9	1	0
Pork chops	0.20 per lb.	0.20	1,580	7,900	16.9		13.6
							5
Beef steak	0.24 per lb.	0.24	1,130	4,710	18.6		12.4
Codfish (salt)	0.20 per lb.	0.20	410	2,050	21.5	1	1.2
Rice	0.08 per lb.	0.08	1,720	21,500	8.0	1	
White bread	0.05 per lb.	0.05	1,215	24,300	9.2	1	13.4
Breakfast food oat (cooked)	0.10 per lb.	0.10	285	2,850	2.8		4.5
Potatoes	0.60 per bu.	0.01	385	38,500	2.2	2	3.2
Parsnips	0.40 per bu.	0.0066	230	34,500	1.6	2	10.7
Beans	0.20 per lb.	0.20	3,285	16,400	16.6		13.2
Nuts	1.00 per bu.	0.0166	290	17,400	4		4
Apples	0.20 per doz.	0.044	460	10,400	1.3		4
Bananas							

The above table shows the amount of nutrition that one dollar will purchase when buying common foods. Two things should be taken into consideration in studying the table.

First. That the calorific value of a food expresses the amount of heat and energy that the food in question will supply. Fats are the greatest heat producers, therefore are high in calorific value.

Second. That the protein content expresses the value of the food as a muscle producing food.

Therefore, we see from the table that more heat and energy can be secured for the money expended by buying potatoes. Parsnips rank second in this respect and beans third.

It will also be noted that more muscle building food can be obtained for the money expended in buying beans. Parsnips rank second and potatoes third.

It is not to be wondered at that Ireland, whose main article of food has been potatoes, should in two centuries develop a race that has become such a potent factor in the development of the new world, and whose descendants are playing such an important part in every walk of life.

While we have all realized that potatoes are of value as food, it is doubtful if a great many people have ever had the matter presented to them in such a manner that the food value of potatoes could be compared with that of any other well-known food, like it has been in the tables presented herewith. I think we will all agree that the potato is one of Michigan's valuable productions and that steps should be taken to preserve and utilize all the potatoes grown in this State.

FEASIBILITY OF USING THE DRYERS AT PRESENT USED IN BEET SUGAR AND CHICORY FACTORIES FOR THE DRYING OF POTATOES.

Upon the subject of whether the dryers now used in the drying of beet pulp and chicory can be utilized in the drying of potatoes, I am submitting the communications received from the different managers of the beet sugar and chicory factories, together with my deduction in regard to the same. I am submitting these communications in their entirety because every one brings out some particular point which the others do not contain, and I am anxious that the readers of this report should have first-hand information as to what the people who are best equipped to judge in these matters, think of the proposition of using the different appliances at hand for the purpose of drying potatoes.

St. Louis, Michigan, March 20, 1915.

Your letter of March 13th asking information regarding the use of beet pulp dryers in drying potatoes has been received.

Our engineer thinks these dryers can be untilized equally as well for potatoes as for beets, although there necessarily should be a number of minor changes made in order to handle the product; however, the cost of doing this work would be large owing to the capacity of each drying unit, and the necessity of having great quantities of potatoes on hand.

As to the likelihood of this Company being interested in the undertaking it will be necessary for you to get an expression from the General Manager at Holland, Michigan. The percentage of moisture in a ton of green pulp is about 94% and the percentage of moisture in the dry pulp is 10% to 12%; roughly speaking it takes one ton of coal to dry a ton of pulp; and the weight of the pulp after the moisture is expelled is about 5% of that of the green pulp before being introduced into the machines.

Should you desire any literature on the subject we would suggest communicating with the Larrowe Construction Company, 1199 Woodward Ave., Detroit, Mich.

Yours very truly,
HOLLAND-ST. LOUIS SUGAR CO.

BCH. ML. L.

Bay City, W. S., Mich., March 22, 1915.

Your letter of the 13th. was received and the answer to the same was unavoidably delayed, which I ask you to pardon.

In my opinion it would be impossible to use beet pulp dryers to dehydrate potatoes for the following reasons.

The initial temperature of the gases entering a beet pulp dryer is too high—which condition is necessary on account of the high moisture content of the wet beet pulp, for which condition of course the dryers are designed.

Also on account of the large capacity per unit of beet pulp dryers, and the fact, as arranged, the material does not stay long in the process.

The beet pulp has approximately from 90 to 92% moisture after the sugar is extracted—is then pressed down to 82 to 85% moisture at

which it enters the drums. After being dryed the moisture runs from 8 to 13%.

As a rule in dehydrating vegetables and fruits the process is a slow one with a low temperature, and it would seem that the process and dryer used in handling chicory root might be utilized, definitely I cannot say, as drying a product of this nature is somewhat of a delicate procedure, to avoid both physical and chemical changes. The usual type used for chicory is the ordinary malt dryer. Several floors of perforated metal are covered with the material thru which heat passes, finally being exhausted at the top. The material starts at the top and is periodically dropped from floor to floor towards the fire which is under the lower floor, the fire and movement of material being so regulated that the product is dry upon reaching the last floor.

Please do not hesitate to call on me, if I can be of further service.

Very respectfully yours,
F. P. S. KELTON,
Supt. W. B. City Sugar Co.

Mt. Clemens, Mich., March 23, 1915.

Replying to your favor of the 22nd instant: we are not familiar with the requirements necessary for drying potatoes or what condition they would go into the drier. We have a pulp drier here that takes care of six to eight hundred tons each twenty-four hours of beet pulp in a wet state, which when dried produces about 5% of the same weight; that is, out of six hundred tons of green pulp about thirty tons of dried pulp is produced. Our drying is done with steam and we have eight machines to take care of our production.

Perhaps with a little more information we could answer your inquiry more intelligently.

Yours very truly,
WM. M. STREIT,
General Manager.

(Mt. Clemens Sugar Company.)

Bay City, Mich., March 16, 1915.

Replying to your favor of the 13th. inst. with reference to concurrent resolution just passed by the Michigan legislature regarding the commercial possibilities for dried potatoes and the utilization of the pulp driers in the sugar beet factories.

The general superintendent of this company, Mr. Henry A. Vallez, is in the West at present and will not return until after the first of April. As the writer has no data at hand regarding the drying of potatoes, it would be impossible to state whether or not a beet pulp drier would be adaptable to such a purpose. We will refer the matter to Mr. Vallez upon his return, and are sure he will be pleased to go into the question further with you if you so desire.

Answering your questions regarding the drying of beet pulp, would

say that the per cent of moisture in the green pulp as it leaves the diffusion battery is about 98. This is then pressed in presses especially constructed for the purpose, which process reduces the moisture to 85 to 86%. The pressed pulp is then passed through cutters which separates it into fine particles. The object of the cutting process is two-fold; first, economy in drying and, second, making it much more quickly and thoroughly moistened for feeding. All dryers, however, have not the cutters installed. The per cent of moisture in the finished dried pulp is about 10.

Our experience is that the drying process requires from 65% to 70% of coal to dried beet pulp produced. The production of dried beet pulp to beets sliced in the factory ranges from 5% to 5½%.

There are two types of dryers in use—direct heat and steam, both of which have their peculiar advantages. The method of the process in both is practically as outlined above.

Please be assured that, as far as this Company is concerned, there are no secrets in our process, and we hope you will feel free to ask of us any information you may want. If it is in our power, we will furnish it cheerfully.

Yours very truly,
GERMAN-AMERICAN SUGAR CO.
E. WILSON CRESSEY,
Secy. & Gen. Mngr.

Saginaw, Michigan, March 25, 1915.

With further reference to drying machinery.

I find upon further investigation that our kind of a drier, with the use of hard coal instead of soft coal, is exactly what they are using in Germany.

I had a conversation yesterday with a man who has been in Germany several times, has been interested in these matters, and he tells me that this is true. Jackson & Church, of this City, are the manufacturers of such driers in this country.

Further, other concerns who are making driers for other vegetables are as follows:

F. D. Cummer & Son Co., Cleveland, Ohio.
Jos. T. Devine, Buffalo, N. Y.
Buffalo Foundry & Machine Co., Buffalo, N. Y.
Ruggles Coles Engineering Co., 50 Church St., N. Y. C.

Some of these people may be able to put you in touch with the necessary equipment for preparing the potato for the drier.

Yours very truly,
W. H. WALLACE,
General Manager.

WHW/VLB.

Belleville, Ont., Mar. 19, 1915.

We have your favor of 17th. We are at present operating two large plants in the manufacture of Des. potatoes, the one at Mayville, Tuscola County, and the other at Casnovia, where they are using combined about

1000 bushels per day. There are no more factories apparently in Mich. available to do this work properly. I may say we are operating also seven of these factories in Canada.

Yours truly,
THE GRAHAM CO., LIMITED.
R. J. GRAHAM, President.

Belleville, Ont., Mar. 24, 1915.

We have yours of 22nd. Dried potatoes for potato flour are done entirely different from the process we use. The Fued Milling Co., of Detroit for many years made a specialty of potato flour, and may still be in business for what I know. We do not make potato flour but the process is quite simple. The potatoes are simply sliced and dried and are not peeled but just washed and after drying they are ground and put through a bolt cloth just the same as wheat flour, the skins coming out the same as bran.

Yours truly,
THE GRAHAM CO., LIMITED.
R. J. GRAHAM, President.

Owosso, Mich., March 17, 1915.

Your communication of March 13th addressed to this company has been handed to me by our Assistant Secretary, Mr. B. E. Smith, for reply. The following replies are in the same order in which you have asked the questions:

1st. Can the present sugar beet dryers be utilized in drying potatoes for the purpose of shipping them to European countries? Ans. Yes.

2nd. Do you think your company would be interested in the undertaking? Ans. Yes, if the drying of potatoes could be accomplished when we are not engaged in the manufacture of sugar. No, if the drying of potatoes would have to be done between the months of October and December, both inclusive.

3rd. What is the percent of moisture in a ton of green pulp ready for the dryer? Ans. 87% is about the average.

4th. How many lbs. of coal does it take to dry a ton of green pulp? Ans. It takes anywhere from 90 to 100 pounds of coal to dry a ton of green pulp.

5th. What is the weight of the pulp after the moisture is expelled? Ans. This question is somewhat ambiguous. We presume you want to know how much dry pulp is produced from a ton of wet pulp. One ton of pulp on the average will produce 100 pounds of dry pulp.

Yours truly,
OWOSSO SUGAR COMPANY
Per C. D. BELL (Superintendent.)

CDB/LB

Bay City, Michigan, Mar. 17, 1915.

Your letter of the 13th received. As our Superintendent is a German and knows considerable about the German methods of handling potatoes —I asked him to give me some information regarding it, and I enclose you a copy of what he says regarding pulp, also the drying of potatoes. I also enclose you a sheet regarding drying of potatoes—he has only translated a small portion of it—if you desire the balance translated and forwarded to you—I will be glad to do so. Mr. Eckert is translating it, and I will be pleased to furnish it to you—if you so desire.

I do not know, but believe the Chicory Driers would be better for drying potatoes than our beet pulp driers.

I had no literature regarding the drying of pulp that would be of any use to you. I do not know as I have furnished you with what you desire, but you can use what is of any use to you.

Any further assistance I can give you—I will be pleased to do so.

Yours truly,
EUGENE FIFIELD.

Referring to attached letter from Mr. Carton, Secretary of the Public Domain Commission, about drying of potatoes in driers as used in sugar factories and questions in connection.

The beet pulp driers can be used for drying potatoes, some changes, however, have to be made in the machinery preparing the potatoes for the drier, as the washer, slicer and conveying machinery.

A ton of wet pulp going in the furnace contains about 88% of moisture, that is 1,760 lbs. of water, when the pulp leaves the drier one ton contains from 240 to 280 lbs. of water, or 12%-14% moisture.

A ton of pulp ready for the furnace needs about 190 lbs. of coal, and the yield will be about 273 lbs. of dry pulp of 12% moisture, which equals about a little over 5% in weight of beets. 7.73 tons of wet pulp coming from the presses are needed to yield one ton of dry pulp, this amount, of course, varies somewhat, depending on the moisture in the pressed pulp and in the dry pulp.

The moisture in the potatoes depends on the soil, kind and season, the German potatoes average 80% moisture, the American probably the same. The yield not only depends on the moisture but also on the contents of starch. A German book, written in 1912 by a very reliable author, says that:

4 tons of raw potatoes will give 1 ton dry, if starch is:—16%;
3.6 tons of raw potatoes will give 1 ton dry, if starch is:—18%;
3.3 tons of raw potatoes will give 1 ton dry, if starch is:—20%.

The cost of drying per ton of raw potatoes is given $1.80-$2.60. The capacity of driers is given from 550 lbs.-3,300 lbs. of raw potatoes per hour; this is per unit. The smaller driers are portable and are used in the fields.

The dried potatoes are used as fodder for hogs, sheep, dairy cows, fattening steers, horses and poultry of all kinds, in place of barley, oats and corn.

But lately steam driers are used and the dried potatoes are sold as "potato flake" to bakeries, etc., and used as high as 40% with flour for bread. Such bread is sold in Chicago in West Side bakeries. For this purpose the preliminary processes for drying are more thorough, the potatoes are washed, steamed and squeezed between two steam heated rolls which rotate slowly and from which the potatoes are scraped, ground to flour or farine and sifted.

Sugar factories could consider the drying of potatoes only after the beet season and at that time the weather is so cold that the potatoes would freeze and spoil and this fact would necessitate the storing until milder weather. For this reason and also on account of freight the German sugar factories do not dry potatoes. The two crops are taken care of at the same time, and smaller driers at a number of places are used, reducing the cost of freight. The drying of potatoes in Germany has been a financial success since 1903, and the manufacture of potato flakes and flour since 1907, when steam driers passed the experimental stage.

I do not know of any books in English treating the subject of potato drying. There are several in the German language and I am translating from a German book on drying, that part which treats "drying of potatoes," and I attach one sheet. There will be about ten more, and this will require some time. I thought I had better answer the letter and let the translation follow as soon as finished, as probably the above short outline will contain all the information needed just for the present.

Yours very truly,
J. S. ECKERT,

March 17, 1915.
Sheet 1 of article on drying of potatoes attached.

The following article on drying potatoes has been translated from a German book on this subject, published in 1908. The author is Dr. Diedrich Meyer; the title of the book: "Die kunstliche Trocknung der wasserreichen Futtermittel" (The artificial drying of fodder abounding in water).

The Drying of Potatoes.
General.

As already stated in the chapter about root crops, the preservation of the same for the German agriculture is of the greatest importance. A reduction of the root crop would not only mean a return to a more extensive farming, but also a very great loss in national wealth.

The potatoes take the first place amongst root crops, over 8 million acres planted with it, the total acreage of all the other root crops amounting to only 3 millions.

The following figures show how the conditions have changed with the potato crop during the last 5 years compared with the previous 5 years.

	1897-1901	1902-1906
Planted acres	7,682,381	8,084,687
Crop in tons	40,017,391	47,060,457
Yield per acre in tons	5.2	5.8

Not only the total production of potatoes shows a considerable increase but also the acreage planted. The increase during the last 5 years being 402,306 acres, the increase in tonnage 7,043,066 tons. The yield increased 1,200 lbs. per acre. (During the years 1897-1901 the yield has been 208 bushels per acre, during 1902-1907 the harvest was 232 bushels. an increase of 24 bushels per acre.) These figures show that the potato crop has nearly become a vital question for the German farming.

With the steady increase of the potato crop the consumption has not kept pace by any means, so that in years with good crops a considerable surplus was on hand and consequently a profitable sale was an impossibility. It is out of the question to think about an increased consumption by distillers and starch manufacturers, on account of overproduction in these branches, and therefore the only profitable use of the increased crop is for feeding purposes, and this by changing it into a dry feeding material. This means that not only the overproduction of very good years can be kept for poorer years but also a prevention of the losses which occur when siloed. One can assume that during the winter months a loss of 10% on an average takes place in the siloes, that is the loss in substance, but which can be considerably more with potatoes which do not keep well or in years when potatoes are more inclined to rot, which is shown by test made by Gerlach. The losses amounted during a storage from September 25 until March 30 with three different grades of potatoes to 24.2% of the dry substance on an average. The method used so far for keeping potatoes which were intended for feeding during spring and summer was the lactic acid fermentation.

Detroit, Michigan., March 24, 1915.

Your letter of the 13th, was received some time ago, and I fully intended to answer it promptly, but, on account of rush of work was unable to do so.

As regards drying potatoes, and the manufacture of potato flour, will say that it would probably take six weeks to start a suitable mill and plant such as we had at Tawas. I cannot recall the capacity of the plant, but believe it was five hundred bushels every day. After the flour is manufactured comes a hard pull to find a market for it. The first two years we operated the plant at E. Tawas we were educating the public to use the flour, which as you know, is an expensive proposition, especially when the commodity is used by so few people, such as bakers.

I do not know of any potato flour made in this country, unless there is a manufactory in Minnesota. The principal reason we were obliged to give up the manufacture of this flour was that we could not buy the raw material cheap enough. When we could buy potatoes at 25 cents a bushel, there was some profit in the business.

The mill was operated only a few years at Hart, and was then abandoned. As a suggestion, I should think it would be well to look to potato starch factories as an outlet for the surplus production of the potatoes.

Yours very truly,

WM. O. EMORY,
471 Field Avenue.

St. Thomas, Ont., Mar. 27, 1915.

Your favor of Mar. 22nd. addressed to Manager, the Graham Co. Ltd., Casnovia, Mich., was handed to me just as I was leaving there yesterday.

I note with interest the enclosed copy of resolution passed by Mich. legislature, Re dried potatoes. Have been unable to find any market for same, except with British government, of which ours at Casnovia, and Mayville is a part of Canadian contract. This business is all awarded to Canada men. I had interests at Casnovia that made it to my advantage to give that factory a chance to operate. We could easily do much more at factories to be had if we could market the goods. Sorry I am unable to cite you to a market. We put the product in sealed cans, 15 lbs. each. Do not mix with other vegetables, but do make a mixture of other vegetables for a soup product.

I will be in Mich. again in about a week and if possible will call on you. If there is any chance to market the goods I could arrange to turn out almost unlimited amount. I am interested to know the different beet and chicory plants have driers. I would esteem it a favor if you could tell what method of drying they use, and if open to operate at reasonable profit. Can only use steam dryers.

Very truly yours,
CHAS. WHITNEY.

Mayville, Mich., Mar. 23, 1915.

We have yours of the 22nd. to hand this A. M. and in reply beg to say that we are drying potatoes at Mayville and any information we can give you at any time will be given cheerfully.

Now I will explain just as fully as possible what the process of manufacture is on this particular kind we are making here. First, of all, they are peeled by a machine. These machines are made in several different places and will give you the address of the maker of the machine we like best if you so desire. These machines will peel and wash about 300 bushel in ten hours. Then we have a number of women to trim out bad spots and deep eyes. This costs considerable, especially this season potatoes are a very bad sample as a rule. Then we slice them in an ordinary apple slicer and give them just a little bleach with brimstone to keep them a good color. Then we spread them on trays and slightly cook them just enough to set the starch. Then we dry them thoroughly. They are a golden color when finished. We are not mixing them with other vegetables, but they are packed in tins holding fifteen lbs. and two tins are then put in a wooden box, the total weight of which is 45 lbs. We call this variety "cooked sliced potatoes." Then there is another style of potato called "shredded." These are made by peeling, then cooking whole, then putting through a shredder and dried. We will try to send you samples of each of these in the course of a few days.

We do not know of any permanent market for these. We are working on a contract for war supplies. We do not make potato flour and so do not know anything about that business. We might say in conclusion

that potatoes are much more expensive to work up than apples and unless they can be bought cheap, there is no money in the business.

If we can give you any further assistance at any time we will be pleased to do so.

Yours truly,
The GRAHAM Co.
Per. A. M. McDonall.

Flushing, N. Y., April 6th, 1915.

With further reference to your letter of the 22nd ulto. We are advised that it would be possible to dry potatoes on our kilns.

We are unable, however, to get any information as to what market there would be for such dried product, except for the purpose of feed, which, however, would scarcely be practical as the cost of drying would be rather high.

If you can give us any idea as to what market there is for such dried potatoes, also whether they would have to be peeled before drying, we would be glad to go further into this matter.

Yours very truly,
HEINR FRANCK SONS, Inc.

"THE RURAL NEW-YORKER" of February 6th, 1915, discusses it in a very able editorial called: "THE POTATO CROP—A SERIOUS MATTER. We Must Find New Markets," and urges people to use every effort to encourage the use of potatoes, not only in nature's original package, but in every other form which can be reasonably introduced.

From all the uses to which the surplus potato can be put, the most advantageous at the present time is unquestionably the manufacture of potato flour. We have mentioned before that there is an established market for potato flour and that all the flour used in this country has been imported from Europe. Most, if not all, of it came from Germany, and as it is needed at home at the present time, the export is forbidden. The consequence is a great scarcity of that commodity, and people accustomed to its use will no doubt be willing to pay a good price for it, and they will have to. Anyone starting an industry of that kind can be sure to make it pay BIG.

There is another good chance in the United States to make BIG MONEY with the drying of potatoes. The Flocken make instantaneously the most delicious mashed potatoes. Prepared properly, put up in nice cartons, they would find a ready market in the household, and especially in mining and logging camps of the Northwest, where fresh potatoes are scarce and very expensive. Flocken will keep indefinitely in any climate, as long as they are kept in a dry place. Mashed potatoes are a national dish, people can hardly make a meal without them and if they can be bought at the grocer's with a label saying: "Add some hot milk, some butter, salt and pepper to taste, and serve" they surely would find a ready sale, even in cities.

We have said that in America potatoes are grown exclusively for human food. With this we meant to say that potatoes are grown to suit the palate of the consumer, regardless of their starch content. When potatoes are used for industrial purposes, much attention is given to their breeding for starch content, as is done in Germany, for example, where potatoes contain as high as 25% of starch.

The American potato, not having a high per cent of starch, can not be used very profitably for the manufacture of alcohol or starch. But, if a potato is declared to be a good eating potato, and accepted as such by the consumer when fresh, it will be just as readily accepted when dry, because the drying process, when operated with the right kind of machinery, does not change in any way the quality and the palatability of the potato.

This is one reason why we say that the most advantageous utilization of the surplus potatoes is the manufacture of potato flour. Another advantage, quite important from the manufacturers' point of view, is the fact that both, the Flocken and the flour, can be made just as cheaply and just as good from the small, unsaleable potatoes and from the culls, as they can be made from the large tuber. The small potatoes can be purchased cheap, and the culls for almost nothing; they are seldom picked up, because there is no market for them.

THE POTATO DESICCATING INDUSTRY.

In America potatoes are grown exclusively for human food. Not so in Germany. Immense quantities are grown for industrial purposes and used for manufacturing starch, denatured alcohol and for drying, all of which are important industries.

The Germans started experimenting with the drying of potatoes some 10 or 12 years ago, and it was such a success and profitable business that today there are far over 500 potato drying plants in Germany alone, some in Holland and Sweden.

The development of the potato drying industry in Germany, has been the result of over-production and low prices. In years of over-production the farmers were obliged to accept ruinously low prices for their crops and were at the mercy of the potato merchants. The potato, being perishable, cannot be carried over from one year to the next, as is the case with grains. It is easily frozen and when once frozen is ruined, so that the disposition of a surplus in a good year was a serious problem. The drying not only utilizes the surplus, but preserves it in a form in which it can be held indefinitely and stored without danger of freezing. It also takes the surplus off the market and insures a reasonable price for the rest of the crop.

During the first stage of this industry in Germany, the potatoes were dried to be utilized as hog-food; little by little, however, the use of dried potatoes became general on the farm, and was used not only for hogs, but also for cattle, horses, mules, etc., and even the Government uses dried potatoes for army horses, with excellent results.

Then it has been discovered that, if potato flour is mixed in a certain

proportion to other flour for the baking of bread, that that bread is much better, more palatable, and especially that it keeps fresh much longer; it came into general use. From using potato flour in bread, it spread to other bakery goods, and it is today a household necessity in all the countries of Northern Europe. Regular cook books are published for the utilization of potato flour in the kitchen.

Immigration introduced the use of potato flour in this country and created a market for it. It is impossible to know exactly how much potato flour there is imported, because the Government enters potato starch the same as potato flour; powdered potato starch is wrongly called potato flour, and that is the reason. The importation of these two products in 1913 amounted to 16,710,498 lbs.

What is true for Germany is true for the United States, as to overproduction and low prices. The U. S. farmer is even at a greater disadvantage than his German brother, on account of the American market which would not accept a potato below a certain size. Therefore, the small potatoes and the culls are almost a total loss and scarcely ever harvested. The Bay City Tribune of Feb. 15th, 1915, publishes the prediction of a local dealer at Dowagiac, Mich., that potatoes will drop to 10 cents a bushel. It is this very same fact that made the drying of potatoes such a great success in Germany right from the start, and that should also be the reason to make it a success in this country.

People begin to realize the necessity to utilize the surplus potatoes. Universities and Agricultural papers are discussing that question more and more, looking for the best solution.

From the communications received in regard to the using of the beet pulp dryers in the State and especially in view of the statement made by Mr. William H. Wallace, who is general Manager of several factories in Michigan, I would say that the dryers of the factories can be used for the drying of potatoes.

E. SALICH & CO.,

Consulting and Constructing Engineers.

Chicago, Ill., March 15th, 1915.

We have your favor of the 11th. To start with, we are sending you under separate cover a small sample of dried potatoes, called "Flocken" in Germany, a name for that product which also prevails in this country. Still, some call it also "Flakes."

In another sample, sent also under separate cover, you will find potato flour called in Germany "K-Flour," K standing for "Kartoffel." These two samples will give you an idea how the product looks, and how it is brought on the market.

Last month, a prospective customer asked us to give him an idea of that industry, and it occurs to us that this would be a good reading matter for you, too. It will show you how that business started. We enclose, therefore, a carbon copy of that description. Additional questions may present themselves, which you can put up to us for answer.

You will see that over 16,000,000 lbs. of that stuff has been imported

from Europe in 1913. That was before the war, of course. We may add that at that time the Chicago importers sold it to wholesale grocers at 4 to 5c per pound.

There is no desiccating plant operating in this country. In Germany it costs them less than $1.00 per ton to dry the potatoes. Double it for the U. S. and use only the potatoes for which there is no market, and you can figure out what a great advantage a drying plant would be for a farming community.

We have a party interested in the drying proposition, and when we learned of the large amount of surplus potatoes available in Michigan, we wrote to Mr. Jas. N. McBride to ask how much these potatoes would cost, or could be purchased for. Mr. McBride refers us to you. Can you tell us?

Do not hesitate to ask us any additional data which you may need or want. We will be pleased to give it to you, if it is in our power.

Very truly yours,
E. SALICH & CO.,
Per E. Salich.

MARKET.

Following are the communications received in regard to the market for dried potatoes, or potato flour:

The letter from Mr. A. C. Carton was handed to me and I beg to report as follows:

COMMISSION FOR RELIEF IN BELGIUM.

I called on Mr. Mellinger, who is the Food Expert for the above Committee, at his office on the twentieth floor 71 Broadway. He informed me that their Committee was the only one authorized to ship food into Belgium, and as that country is the only one taking any great amount of food from this country, it would seem that this would be the only possible source of outlet supplying the poor people of Europe. It seems that Mr. Mellinger has been endeavoring for some time to find some group of factories that could economically do the very thing that Mr. Carton inquires about, but to date had been unsuccessful in getting any very definite information. I have had a copy of Mr. Carton's letter made and sent to Mr. Mellinger, at his request. He will be very glad to communicate direct with Mr. Carton, and stated that if potato flour could be made and sold at less cost than wheat flour that there would be a big market for it; also, that if dried potatoes could be prepared and sold at a cost to compete with beans that there would be a very big market for this product.

Yours truly,
G. B. BOGART.

GBG/AP
Enclosure
P. S. Attached is a report prepared by Mr. Mellinger on the suitability of potatoes for shipment to Belgium.

REPORT UPON THE SUITABILITY OF POTATOES FOR SHIPPING TO BELGIUM.

There are a great many difficulties connected with the export of this vegetable, together with other root vegetables.

The Commissionary Department of the Panama Canal purchased large quantities of potatoes for shipment to Panama, and it, together with other exports, report as follows upon the advisability of shipping potatoes to Belgium:

First: It requires ships of more than one deck, as potatoes cannot be stored in the hold of a vessel or near the boiler rooms, but must be stored between decks, where they can be well ventilated. As you undoubtedly know, by the great amount of publicity recently given this subject, that some of the warring nations furnish most of the ships engaged in maritime commerce, and that the ships of this country, and of the neutral nations, are comparatively few in number. Therefore, this Commission has been unable to secure the type of ship which has more than one deck, and which is suitable for the transportation of potatoes. There are none in sight at the present time, and it is very questionable if there will be any in sight for some time to come. Consequently, it will be very difficult for us to ship potatoes at the present time without spoiling.

Second: Their shipment will require a great deal of time and trouble, both in the selection and packing. They would have to be rigidly inspected at the time they were purchased. If shipped in carload lots they would have to be placed in crates, or barrels, at the port for suitable loading to the ship. Before being placed in these containers they would have to be reinspected, so as to prevent any frostbitten or bad ones, from remaining among the good ones, for a bad potato would injure all the good ones near it.

Third: There is a serious economic point to be considered in the purchase of potatoes. They contain 78 per cent water, and consequently, if we loaded a ship with nothing but potatoes 78 per cent of the cargo would be water, whereas with wheat flour, cereals, etc., the percentage of water runs only from ten to twelve per cent.

Fourth: From a nourishment standpoint, potatoes are much inferior to the grains we are sending, for they furnish only 385 calories of heat per pound, whereas the grains average around sixteen to seventeen hundred calories per pound. Therefore, to obtain the same amount of nourishment in potatoes that is contained in these grains, it would require four and one-half pounds of potatoes to one pound of wheat flour, and the cost in an equivalent amount of nourishment in potatoes, regardless of their exceedingly low prices, would run to double that for flour.

March 19, 1915.

Mr. G. B. Bogart, of this city, has sent to us a copy of a letter written by you suggesting that machinery used in connection with drying the pulp of sugar beets in Michigan might be readily used to convert the enormous potato crop in Michigan into dehydrated potatoes. If this were possible, it would probably make this excellent foodstuff suitable for export, and besides would help to better the domestic markets by

relieving them of the large surplus which is on hand due to the enormous crop just harvested.

In connection with the above, we might state that the Commission has been exporting large quantities of foodstuffs to Belgium. It has had potatoes in large quantities offered to it on numerous occasions, but because of their perishable nature and the difficulties encountered in exporting them, it has been unable to accept them. We are enclosing a report with this letter, which explains these difficulties.

It has occurred to us that it might be possible to get some of these potatoes which have been offered to us run through a plant which would take the water out of them, or in other words dehydrate them. This would make them unperishable, and besides would make them more economical to ship, the greater part of the 78 per cent of water which they contain having been extracted.

We have endeavored to locate dehydrating plants which could do this, but to date we have not been able to find any which have had a capacity large enough to furnish the Commission with an adequate quantity. The largest dehydrating plant which we have located has only had a capacity of about two cars of dehydrated potatoes per week.

We might add, to make dehydrated potatoes economically advisable for the purposes of the Commission, their cost would have to compare favorably with the cost of dried beans, or, if they were dehydrated in flour form, it would have to compare favorably with the cost of wheat flour. Otherwise it would be more advantageous for the Commission to use these articles, as it is these very articles which the Commission hopes to partially displace and lessen the cost of by the use of dehydrated potatoes.

If you know of any plants in Michigan which could dehydrate potatoes on a large scale, and at a cost which would make their sending to Belgium economically advisable when compared with flour or dried beans, or peas, will you please so advise us.

Possibly you might have some suggestion to make whereby part of the large crop of potatoes at present available in this country can be made economically suitable for the purposes of this Commission.

We would be very much interested in receiving anything that you might have to say on the matters contained in this letter.

Trusting the above covers the information which you have asked Mr. Weadock for, we remain,

Very truly yours,

THE COMMISSION FOR RELIEF IN BELGIUM,
Purchasing Department.
Per E. G. Broenniman.

EGB:FHM:M.
Enc.

March 27, 1915.

Your letter of March 22 has been received.

In reply we would state that the Commission cannot advise you as to how large the market or demand would be for dehydrated potatoes, and as to whether it would be large enough to warrant the big companies in equipping their plants for dehydrating them. The Commission

is only able to advise you upon this subject as to its own requirements in this respect.

In this connection it will state that during the last several months it has been offered large quantities of potatoes as donations, but which it has had to reject for the reasons stated in our previous letter. It has endeavored to find some way in which these potatoes could be used by dehydrating them, but it was unable to locate plants with a sufficiently large capacity to warrant it in entering such an arrangement.

If there were plants in current operation here which could furnish a very large quantity of this product at a cost less than wheat flour per barrel, or beans per hundred pounds, then it could probably find it economically advantageous to have potatoes which might be donated to it run through this process. But, as previously stated, to consider a proposition of this nature, the quantities would have to be large and the price more reasonable than wheat flour, or beans; otherwise there would be no reason for it to shift to potatoes instead of continuing to buy these other articles.

Strictly from the standpoint of Belgium's requirements, it does not think it advisable for any plant to consider putting in extra machinery to engage in such a purpose; for there is no telling how long this demand will last. It might last thirty days; then again it might last for some months, depending entirely upon the range of prices of other food commodities and the length of time which Belgium will draw upon this country for food supplies.

We trust that the preceding will satisfactorily answer the questions asked in your letter and will thoroughly explain to you the attitude and status of the Commission upon this subject.

Thanking you for your interest in this matter and for your endeavoring to co-operate with us, we are,

Very truly yours,

THE COMMISSION FOR RELIEF IN BELGIUM,
Purchasing Department.
Per E. B. Brocuniman.

EGB:FHM:M.

DEPARTMENT OF AGRICULTURE.

BUREAU OF CHEMISTRY.

Washington, D. C., March 31, 1915.

Replying to yours of March 13 and attached resolution, would state that so far as the Department is informed there are no potato drying establishments located in the United States with the exception of several firms which are preparing dried potatoes in a small way for use as food.

In Germany potatoes are very extensively dried by two processes. The first consists in cutting them into slices or thin strips and passing them through a rotating dryer which is either steam heated or supplied with flue gases passed through at high temperature. The product so obtained finds use as a stock feed. The second method consists in washing and

steaming the potatoes and drying by passing them between steam heated rollers. The material is obtained in the form of flakes, and form a high-grade stock feed, and is also used as a food for man. This second process involves large investments and the Department does not recommend it for adoption in this country. The Department is now experimenting with a third process for drying potatoes which consists in crushing the potatoes and pressing them between rollers so as to remove a large portion of the juice and then drying the pulp which remains. This process is still in the experimental stage and not ready for commercial development.

It is suggested that you take up the commercial possibilities of drying potatoes with manufacturers of beet pulp dryers in this country for drying beet pulp. Addresses of four manufacturers of beet pulp are given below:

The Dyer Company, Cleveland, Ohio;
Larrowe Construction Co., 1199 Woodward Ave., Detroit, Mich.;
Bay City Iron Co., Bay City, Mich.;
McKinnon Boiler & Machine Co., Bay City, Mich.

Although it is not improbable that the pulp dryers in a beet sugar factory can be used successfully in drying potatoes, there is, so far as the Department knows no definite information on this subject. We are advising the four manufacturers named above of this reference of the subject to them.

Respectfully,
CH. ALSBERG,
Chief.

AMERICAN RED CROSS.

BUREAU OF MEDICAL SERVICE,
1624 H Street, N. W.

Washington, D. C., April 1, 1915.

Referring to your communication of the 26th ult., I have to advise you that the American Red Cross is not shipping food stuffs to Europe to any of the belligerent powers. Our relief work is confined to furnishing doctors, nurses and medical, surgical and hospital supplies.

Very truly yours,
ROBT. U. PATTERSON,
Major, Medical Corps, U. S. Army,
Chief of Bureau.

RUP/M.

Communications from constructing engineers and manufacturers of machinery to be used in the preparation of potatoes for drying:

E. SALICH & CO.

CONSULTING AND CONSTRUCTING ENGINEERS

1602 Monadnock Bldg.

Chicago, Ill., March 27, 1915.

We hope that the delay sending you the cost of a potato drying plant did not inconvenience you any.

We think that a capacity of 4,000 lbs. of fresh potatoes per hour will just about suit your conditions. Such a plant can operate 5 months (150 days) per year. If the plant dries 100,000 lbs. per day, it will dry 15,000,000 lbs. per season. This means 2,500,000 bushels in 150 days.

According to the figures received from you, you have this year $1,000,000.00 worth of surplus potatoes. At 20c per bushel you have 5,000,000 bushels.

You see, that two plants like the one we propose, would take care of that amount. Suppose that buildings, setting up the machinery, etc., will cost another $25,000.00. In that case with an out-lay of $100,000.00 you would have been able to save the surplus of $1,000,000.00. No doubt, you would have been able to dispose of these dried potatoes at $1.50 per C. (Beet pulp brings almost that much) and figuring 18c manufacturing expenses per 100 lbs. of finished product, which we take from a report we have before us of a German drying plant, it would pay you 20c per bushel for the raw potatoes.

This sounds pretty good, it seems to us, and it becomes more attractive when you come to think that you can keep that product any length of time without spoiling it, and naturally the prices get better when the potatoes are getting scarce.

That much for the actual surplus which, of course, is an exception. But there is always, and every year, the small unsaleable potato, and the culls. That alone will make a drying plant pay.

Very truly yours,
E. SALICH & Co.
Per E. Salich.

E. SALICH & CO.

CONSULTING AND CONSTRUCTING ENGINEERS

1602 Monadnock Bldg.

Chicago, Ill., March 27, 1915.

Please find below an approximate estimate of a potato drying plant, having a capacity of 4,000 lbs. of fresh potatoes per hour. This will give you approximately 1,000 lbs. dried product.

Only the machinery is included in this estimate, as you may wish to utilize some existing building; the enclosed sketch may give you an idea as to the building. The machinery includes:

1—100 H. P. Steam Boiler,
1 35 H. P. Steam Engine,
1—Inclined elevator to lift the potatoes to the washer.
1—3-compartment Potato washing machine.
1—Vertical bucket elevator,
2—Potato steaming kettles,
2—No. IV Flocken machines, complete with pipings, fan, etc.
1—Water pump, 5,000 gals. capacity per hour,
1—Water tank,
Shafting and belting.

The approximate cost of that machinery will be $25,000.00, more or less, of course, according to local conditions. The enclosed building sketch will help you to determine the cost of same.

Hoping this will give you the required information, and at your service for any other data, we are,

Yours very truly,
E. SALICH & Co.,
Per E. Salich.

March 30, 1915.

We have your valued favor of the 27th inst. regarding apparatus for use in connection with the manufacture of potato flakes or flour. We note that you will contemplate investigating the feasibility of using the sugar beet pulp dryers. While we are not familiar with this type of dryer it has occurred to us that possibly you would be interested in our line of vacuum dryers. We are, therefore, sending you under separate cover a copy of our catalog showing in a general way the various types of vacuum apparatus including vacuum dryers of all types, dry vacuum pumps, condensers, impregnating apparatus, etc.

Regarding machinery for getting the potatoes into shape for drying and also for grinding afterwards would state that we do not manufacture standard machinery of this kind. However, we have all the facilities for making special machinery and apparatus of any kind and if you can furnish us with blue prints or sketches showing what will be required we shall be glad to quote you accordingly.

If you would be interested in conducting tests in drying potatoes under vacuum we should be very glad to extend to you the use of our testing laboratory for making such tests. We presume that it would be necessary to prepare the potatoes for drying, possibly by disintegrating them so that the moisture could be removed more readily. We do not have the facilities for preparing the potatoes in this way but if you could ship us a quantity of the potatoes already prepared for drying we should be glad to dry them in our several forms of dryers so as to determine which type was the best suited for this work.

We have conducted some tests in drying potatoes but not for the manufacture of potato flour. Our tests were for using the potatoes as a stock food and in another case for the manufacture of potato starch. In both these cases the drying experiments were made on raw potatoes.

We remember reading a report contained in the "Daily Consular and Trade Reports" published by the Department of Commerce. This re-

port was on the manufacture of potato flour in Europe and principally in Germany. The report was from Consul General A. M. Thackara of Berlin. We presume you could obtain a copy of this report and probably find it interesting. We do not know the dates of these report but the page numbers were 378 and 379. In a later report Consul General Thackara gave some data regarding this industry in Germany. It is also stated in this later report that in a report on the manufacture of potato flour in Germany reported in "Daily Consular and Trade Reports" for October 21, 1911, that the Tabosin System of potato flake manufacture was described. The first report mentioned above is not that of October 21, 1911, but was published subsequent to that date.

We desire to thank you for writing us regarding this proposition and if we can be of any assistance to you whatsoever we trust you will not hesitate to command us.

Awaiting your further commands, we beg to remain,

Yours very truly,

BUFFALO FOUNDRY & MACHINE CO.

JD-S E. S. Rippel, D. Sales Manager.

Cleveland, Ohio, March 29, 1915.

We have your letter of March 27th regarding potato dryers.

We are enclosing under separate cover catalog describing the Cummer Dryers. We call your attention to our guarantee on Page 4, and the description of our style "F" Dryer on pages 5, 7 and 9.

We are also enclosing under separate cover cut showing our Self-Contained Dryer, equipped with Mechanical Stoker. We understand that after this crop of potatoes is disposed of you will probably want to dismantle the Dryer and sell it. This being the case, we would recommend our Self-Contained type of Dryer, which is enclosed in a steel casing, lined with fire brick. This Dryer is very easily erected and taken down. With our Cummer Mechanical Stoker and special furnace, you will be able to dry these potatoes with bituminous coal, and not contaminate the product.

We enclose herewith an information blank and ask you to kindly fill it in and return to us.

We make these Dryers in a range of sizes, from the smallest with an evaporative capacity of 500 lbs. of water per hour, to our largest with an evaporative capacity of 10,000 lbs. of water per hour.

If you will kindy tell us how many tons of wet potatoes you wish to dry per hour, we will be glad to write you fully regarding the Dryer which we will guarantee to do the work in a satisfactory manner. At the same time we will advise how many pounds of coal you will burn, and how much horse power will be required. In other words, we will supply the drying equipment fully guaranteed in every way to dry your material in a satisfactory manner with a given amount of fuel and power, and without injuring the potatoes as a food product.

Kindly advise when you will be in a position to close a contract for this equipment. We will be very glad to send one of our representatives to see you.

We do not make grinding machines, but purchase quite a quantity of these machines for use in connection with our Dryers, and we will be very glad to supply the Dryer with the necessary grinding machinery.

Yours very truly,

THE F. D. CUMMER & SON CO.,

By F. H. Cummer, Vice-President.

Dict: F. H. C.-B.

New York City, March 29, 1915.

We have your letter of March 27th with reference to dryer for drying potatoes so that they can be manufactured into flour.

We have furnished drying machinery for a great many purposes but, to date, have never furnished one for drying potatoes. We should judge that it would be necessary to pare or, at least, slice the potatoes into small pieces before drying, after which the drying could be done in either one of our Class "C" dryers, described on page 22 of our catalogue, or in one of our Class "F" dryers, described on page 26 of the catalogue, being modified as referred to in the last paragraph on page 26, wherein a steam coil is substituted for the furnace ordinarily used. A copy of our catalogue is being sent you under separate cover.

We have no advices as to the quantity of moisture which would have to be evaporated from the potatoes and if you cannot let us know what this amounts to we will experiment with the ordinary grocery store potato and make allowance for any evaporation which may occur between the time same is dug and placed on the market.

We would also like to be advised as to what quantities would be dried per hour so that we might determine the proper size machine.

If you will let us have this information we will be very glad to write you further and more fully with reference to the machine best suited.

Very truly yours,

RUGGLES-COLES ENGINEERING CO.,

LRC:MHG. L. R. Christie, Treasurer.

Through the courtesy of the Department of Commerce, Bureau of Foreign and Domestic Commerce, I was loaned the office reports from which the following extracts were taken, and the reports then returned to Washington D. C. These reports give us an idea of what is being done in other countries, and what is being done there can be more than duplicated in the United States, once we turn our attention to the matter.

DAILY CONSULAR AND TRADE REPORTS.

POTATO-DRYING INDUSTRY OF GERMANY.

(From Consul-General A. M. Trackara, Berlin.)

October 29, 1912.

The Imperial Ministry of the Interior has published statistics regarding the potato-drying industry of Germany for the campaign year 1910-11, which covers the period from August 1, 1910 to July 31, 1911. A comparison with the two previous campaign years gives the following results:

	1908-9.	1909-10.	1910-11.
Number of factories in operation	170	254	327
	Tons.	Tons.	Tons.
Quantity of potatoes used	160,540	332,642	417,641
Total production	41,574	87,591	107,312
Production for native account:			
Small pieces and disks	5,333	11,709	10,517
Potato flakes	31,687	63,331	84,533
Potato flour	1,509	1,463	1,046
Other products	145	266	300
Total	38,674	76,769	96,396
Production for foreign account:			
Small pieces and disks	1,134	4,240	3,939
Flakes, flour, etc	1,766	6,582	6,977
Total	2,900	10,822	10,916

Of the 327 factories in operation during the campaign year 1910-11, besides potatoes, 13 dried grain, 11 dried the leaves of sugar beets, and 20 dried other agricultural products; 181 of the plants worked day and night shifts of 12 hours each. The 417,641 tons of potatoes used by the 327 drying plants in 1910-11 equalled 15,345,659 bushels of 60 pounds each.

From the above data it will be seen that the efforts which have been made in this country to discover practical and economical methods of preserving potatoes so as to utilize the surplus stocks are meeting with success. In a report on the "Manufacture of potato flour in Germany," prepared at this consulate general and published in Daily Consular and Trade Reports for October 21, 1911, the Tabosin system of potato-flake manufacture was described.

DAILY CONSULAR AND TRADE REPORTS.

Potato Drying in Germany.

June 28, 1909.

Vice-Consul James L. A. Burrell, of Magdeburg, states that in order to cope with the over-production of potatoes in Germany several potato-drying plants are operating in various sections. Such factories are increasing, due partly to the advancing prices of grain. To produce 100 kilos or 220 pounds of dried potatoes 830 pounds of tubers are required, and the product is worth $3.80 to 4.30.

DAILY CONSULAR AND TRADE REPORTS.

Dried Potatoes as Cattle Food in Germany.

(Consul-General Robert P. Skinner, Hamburg.)

February 19, 1913.

The growing recognition of the value of dried potatoes for cattle feeding purposes is reflected in the increase in the number of establishments in Germany in which the various potato products are prepared. At the end of the business year on July 31, 1910, there were 257 such establishments in this country, nearly all of them being operated in connection with large agricultural undertakings. The amount of raw material treated in the year 1909-10 was 332,642 tons and in 1910-11 it was 417,641 tons. (For the amounts of various products from this consumption see Daily Consular and Trade Reports for October 29, 1911.)

What the results will be during the present business year can not be foretold, as the potato crop, especially in this portion of the country, has been most unsatisfactory. It is reported from Luneburg that the abnormal temperature of the autumn months destroyed large quantities of potatoes still in the fields. Efforts to separate the decaying from the healthy tubers were not always successful and many farmers have been obliged to re-assort crops after they had been put in storage.

The use of dried potatoes as food for cattle arose from the impossibility of feeding raw potatoes without causing certain forms of sickness. It was equally impossible to boil large quantities without heavy investment for specially constructed boiling apparatus, and in any event raw potatoes can be preserved during a limited time only and are subject to deterioration toward spring, sometimes being a total loss. These several inconveniences are avoided by drying potatoes according to processes which apparently originated in 1902. By feeding swine and sheep with six different kinds of dried potatoes, it has been proved that the food is digestible. The following table shows the degree of digestibility of each of the elements in various kinds of potato products when fed to swine and sheep:

Stock and food.	Organic substance.	Raw protein.	Extract substances free from nitrogen.	Raw fiber.
	Per cent.	Per cent.	Per cent.	Per cent.
Swine.				
Slices	90.4	53.9	94.2	79.8
Chips	90.8	46.1	94.6	77.8
Flakes	94.6	73.5	93.5	72.9
Chips	90.6	63.5	93.5	72.4
Chips	91.7	70.6	94.3	70.7
Chips	89.4	42.9	93.9	66.5
Average	91.3	58.8	94.5	73.2
Sheep.				
Slices	90.0	53.8	94.7	39.3
Chips	88.6	43.4	96.3	.....
Flakes	83.4	14.4	93.8	.....
Chips	85.2	32.0	92.8	34.0
Chips	83.8	23.5	93.6	.....
Chips	88.0	24.3	94.9	23.5
Average	86.5	31.9	94.4	16.1

The use of these potatoes proved that they were excellent for fattening swine, although not quite equal to barley groats.

According to tests made by the Board of German agriculturists, it was demonstrated that the one-third of strengthening food generally given to horses in the form of grain could be replaced by dried potatoes, and such animals would be kept in excellent condition. In two out of four tests with horses it was shown that dried potatoes accelerated the shedding and re-growth of hair.

The following is a free translation of an extract from a report on the entire subject made to the experiment station at Rostock by F. Honcamp and B. Gschwendner:

The results of favorable tests caused the establishment of a great many potato-drying plants doing excellent work, the more so as a great number of technicians endeavored in the meantime to improve the method of manufacture. Two of the new systems claim special interest, but their products have not yet been tested as to digestibility.

One of these methods is Gumpel's invention. The inventor calls his products "press potatoes," or "papka." The other is the method invented by the manager of the Imperial Machine Works in Meissen. The machines constructed by this concern produce potato chips.

Potato flakes are obtained by mashing boiled potatoes by means of two rollers moving in opposite directions. The product is dried by allowing high-tension steam from the boiler to pass through the interior of the rollers. In the plants constructed according to the Knauer system direct fire gas is introduced and exhausts connected.

OPERATIONS ON THE IMPERIAL SYSTEM.

The Imperial plant consists of the drying apparatus itself with a feeder which can be regulated, the exhaust to remove the hot air, the fan to remove the dust, the heating furnace to supply the hot air, the machine for washing the potatoes, the machine for cutting them into chips, and the pneumatic transporting apparatus. The most important part is the drying machine, consisting of an iron trough in which turns a perforated cylinder made of white metal with rows of small shovels attached.

After the potatoes have been washed and sliced they are placed in the trough of the drying machine, being continually stirred and distributed equally along the entire length of the cylinder by the projecting shovels. A specially constructed apparatus in the upper part of the machine prevents the chips from adhering to each other and helps to distribute the mass equally and bring it into contact with the currents of hot air. The air is forced into the cylinder, passing out through the small perforations. It is said that the chief advantage of this system lies in the fact that a comparatively low temperature 225° to 250° C. is entirely sufficient.

The "pressed potato" method is as follows: The greater part of the content of water is pressed out in a cold state, after the potatoes have been sliced. The mass is then placed in the drying machine. One advantage of this method is that, since comparatively little water is contained in the raw-potato mass, the costs are considerably less than those of manufacturing potato flakes or chips.

Statistics from experiments conducted by Kellner and Moeckern prove that potatoes are excellent fodder, with highly nutritive qualities, and

are digested just as readily as any other of the best feeding materials. It is proved also that the process of drying the potatoes does not in any way impair their digestive properties, except perhaps the protein; but as there are but small quantities of protein in the dried potatoes the food value is not affected.

DAILY CONSULAR AND TRADE REPORTS.

INDUSTRIAL AFFAIRS IN HOLLAND.

(From Consul Frank W. Mahin, Amsterdam.)
November 16, 1911.

FOOD VALUE OF POTATO SYRUP.

The manufacture of potato flour is a large industry of this district. Some of the flour is used in making a syrup, but this industry has been obstructed by allegations that potato syrup has little or no value as a food. An investigation of the subject having been made in the laboratory of the Government University at Groningenm in this district, the conclusion is reached that potato syrup has important food properties.

It is explained that the syrup is made by treating potato flour with diluted sulphuric acid, whereby the starch is changed into dextrin and then the latter partly into glucose. Thus, the syrup is composed chiefly of dextrin and glucose. These the report of the laboratory investigation scientifically discusses, with the conclusion that they are both, if taken as food, readily assimilated, and in the form of potato syrup have a high food value. In addition, it is claimed that dextrin materially increases the secretion of gastric juices. Finally, it is stated that the syrup is obtained from the flour by safe hygienic methods, and that in this regard it is in no way inferior to sugar.

DAILY CONSULAR AND TRADE REPORTS.

POTATOES IN GERMANY.

Extent of Crop and Use for Industrial Purposes.
August 28, 1909.

The manufacture of various products from potatoes in Germany is reported upon as follows by Consul-General Robert P. Skinner, of Hamburg:

The potato crop of Germany is nearly nine times larger than that of the United States, being over 45,000,000 tons, some four-fifths of which are used as food for industrial purposes. Nearly one-fifth are required for seeding. In the manufacture of starch and its by-products, about 4 per cent of the total crop is used, and for distillation about 8 per cent.

In Germany there are hundreds of small concerns in the potato dis-

trict manufacturing potato starch and dextrine. These manufacturers obtain potatoes at from 90 to 125 pfennigs (21.42 to 29.75 cents) per unit of 50 kilos, or 110 pounds. The profit at the factory is said to range from 40 to 50 pfennigs (9.5 to 12 cents) per bag of 100 kilos (220 pounds). The prices for potato flour have fluctuated between $3.33 and $6.19 per unit of 220 pounds, and for dextrine between $3.81 and $7.14, also for 220 pounds. These prices represent goods delivered f. o. b. ship in a German seaport.

MANUFACTURE OF STARCH, DEXTRINE, ETC., FROM POTATOES.

Potato flour is merely ground potato starch, manufactured as starch is usually produced. The residue, parings, etc., are utilized as cattle food, and to some extent in the manufacture of paper, and are in part destroyed.

Dextrine is produced either by heating the dry starch to a temperature of 180° to 260° C., whereby a yellow or brown dextrine is obtained, or by heating the starch, either wet or dry, by means of acid in small quantities, which produces white or practically white dextrine.

The starch is also transformed into potato syrup or glucose, and the latter, upon being boiled and treated with acid, is converted into grape sugar. Potato glucose is chiefly consumed in bakeries and confectionaries, in rice mills for polishing purposes, and is mixed with sugar glucose to produce bonbons and an imitation of honey.

Grape sugar is taken up chiefly in breweries for the manufacture of coloring for beer, and is also used for adding to the weight of leather.

In the United States glucose is manufactured from corn, and exported to Germany and England. The German potato glucose is alleged to contain less sulphuric acid than corn glucose, but, being dearer, does not find as large a market in England as does its American rival.

GERMANY LIKELY TO RETAIN LEAD IN DEXTRINE.

The manufacture of dextrine, although involving no secret process, requires skill and careful manipulation, and German manufacturers, having the advantage of plentiful supplies of cheap raw materials and long experience in the business, are likely to retain their hold upon the trade in general for some time to come. Dextrine was exported from Germany during 1908 to the extent of 3,968 tons, 1,466 tons of which went to Great Britain and 1,395 tons to the United States. Of potato starch and flour Germany exported during the same period 14,464 tons, Great Britain taking 9,115 tons, the United States 1,965 tons, Spain 1,196 tons, and Switzerland 795 tons.

The value of the declared exports of these potato products from Hamburg to the United States during 1908 was as follows: Potato starch and flour, $38,080; dextrine, $9,520; total, $47,600.

DAILY CONSULAR AND TRADE REPORTS.

DESICCATION OF POTATOES.

Recently Developed German Process Prevents Loss by Decay.

February 19, 1910.

Consul Thomas H. Norton, of Chemnitz, described a process recently introduced by a Prussian firm by which potatoes may be converted into a dry concentrated meal. He writes as follows:

The potato occupies a relatively more important position in Germany than in any other European country. It is not only employed largely for food for both man and beast, but also for conversion into starch and alcohol. The 1908 crop was estimated at 46,500,000 metric tons (51,256,950 short tons), 13,000,000 tons being used for human food and 19,000,000 tons for feeding domestic animals. Starch factories utilized 1,500,000 tons, distilleries 2,500,000 tons, while 5,500,000 tons were required for seed. There remained 5,000,000 tons, lost by decay, freezing, etc. German economists have recognized the extent of this national loss, of about $28,500,000 in value, especially because the Empire now imports annually about $72,000,000 worth of cattle fodder. Nearly 40 per cent of this sum, paid to foreign agriculture, could be saved if the loss by subsequent decay in the harvested potato crop could be prevented.

Numerous processes have been submitted in response to an offering of prizes amounting to $6,000. These are based upon two distinct methods of treatment. In the first, sliced potatoes are exposed to the current of hot gases from a furnace; in the second, the "flake process" potatoes are more finely divided, and dried at a lower temperature with the aid of steam coils. This last method is costly. The product of the first method, while available for industrial purposes, is not fully satisfactory for use as a fodder.

A process recently patented and introduced by a Prussian firm seems to have successfully overcome the disadvantages of the earlier systems. The essential features consist in the use of pressure combined with a vaccum for withdrawing the bulk of the water in potatoes, the further drying of the residue by artificial heat, and the isolation of albumen found in the press liquor. This process has been tried with excellent results on an industrial scale.

DESCRIPTION OF PROCESS.

The plant employed is comparatively simple. The potatoes are first thoroughly washed in a large vat provided with a stirring apparatus. Thence they pass into a mashing machine, and the pulpy mass is pumped into a reservoir, and from this is fed through a large funnel into the "suction machine." The latter is the central feature of the plant and presents a somewhat novel form of utilizing the vacuum principle. It consists of two hollow cylinders, one immediately above the other. The exterior is made of perforated plate similar to that employed in centrifugal machines and filter pumps, and is covered with linen filtering

cloth. A pipe connects the interior of each cylinder with an air exhaust. The interior spaces are, however, divided into segments, and the construction is such that the lessened pressure in each segment is felt when it is in immediate contact with the companion cylinder. As the potato pulp passes between the two cylinders, not only their pressure, but also atmospheric pressure, removes nearly all liquid. The residual mass falls into a trough and is conducted by a helical conveyor to small cars. These pass into a hydraulic press, where the mass is finally deprived of all water capable of removal by pressure.

From the press the potato mass is transferred to the drier. This consists of a cylindrical chamber, within which there is a revolving drum, divided horizontally into ten sections. The upper seven sections are heated by connection with a series of steam pipes; the lower three are cooled by means of a similar series, through which water circulates. The pressed potato cake is continuously fed into the top section. From this it gradually descends through openings into the lower sections, one after another, until it finally issues from the bottom compartment and is conveyed to storage rooms. The construction of this revolving drum is such that prongs attached to its axis continually stir up and crumble the nearly dried potato cake, so that it is in coarse grains when it leaves the apparatus. At the same time, by means of properly directed air currents and the aid of the elevated temperature in the upper seven sections, nearly all moisture remaining after the treatment in the press is effectively removed.

POTATO MEAL AND ITS COMPOSITION.

The resultant coarse "potato meal" has one-quarter of the original weight of the tubers employed, and occupies one-eighth of the space. It has an odor and taste similar to that of freshly made bread. It may be used or kept in this condition, or can be pressed into compact cakes for convenience in transportation. The chemical analysis of potato meal, dried as above described, gives the following percentages: water, 11.50; fat, 0.31; protein, 3.73; ash, 2.06; fiber, 1.71; carbohydrates, 80.69.

Pressed potato cake is easily broken up by hand, and can be fed to animals, alone or mixed with other forms of fodder, preferably after moistening with a little water, when it is at once softened.

By the combined processes of pressure and suction nearly three-quarters of the weight of raw potatoes are removed in the form of a cloudy liquor. This portion is allowed to stand in reservoirs until all traces of starch have settled to the bottom. The clear liquid is then boiled and filtered with the aid of a vacuum apparatus. A precipitate is obtained of crude protein amounting to about 2 per cent of the original weight of the tubers. By proper treatment this yields about 80 per cent of technically pure albumen, which is constantly in demand in German markets.

The residual liquors from the protein precipitate contain small amounts of sugar, salts, and nitrogenous matter. They can be advantageously used for irrigation purposes on agricultural lands.

COST OF INSTALLATION AND OPERATION OF PLANT.

The plant requisite for the treatment of 10,000 tons of potatoes during a season of about eight months costs $18,000 to $19,000. The machinery alone, without a press for transforming the meal into cake, costs $12,000. For a building $3,000 suffices, and the remainder is needed for pumps, motive power, washing vats, etc.

The force needed to operate the plant consists of seven men, and includes one engineer, a stoker, one helper, one workman in the potato cellar, two to attend to the machines, and one to handle the residual liquors. If the final product is to be pressed into cakes, the additional cost of the plant is about $4,000, and two more operatives are required. Such an installation can naturally be operated with great economy in connection with a distillery or starch factory.

In practice, it is found that the total cost of preparing unpressed potato meal by the above method (including interest, depreciation, etc.) is $0.56 per long ton of tubers. The additional cost for pressing into cakes is $0.12 per ton of potatoes. In estimating the cost of the fodder thus produced, it is, of course, necessary to deduct a certain sum for the albumen extracted from the residual liquor, as mentioned above. When potatoes are to be raised for supplying regions more or less remote with cattle fodder the advantage of having the nutritive constituents of the tuber in a concentrated form is obvious. Thus, in practice, 3.8 tons of raw potatoes yield one ton of the desiccated product. The freight charges in Germany for transporting (in carloads) the 3.8 tons a distance of 100 kilometers (62 miles) are $3.07. The freight charge, under similar conditions, for the one ton of meal would be $0.81. Adding to this cost, 56 cents per ton, of treating the 3.8 tons of raw potatoes, or $2.13, the total expense of delivering the fodder would be $2.94. At the comparatively short distance of 62 miles there is then a distinct economy in shipping the meal instead of tubers. With every increase in distance there would be a proportionate increase in the saving.

In these days of rising values for all meat products there is a prospect that the newly introduced process will aid materially in decreasing the cost of cattle raising in various sections of the Empire, where stock raisers are largely dependent upon fodder transported from a distance.

DAILY CONSULAR AND TRADE REPORTS.

MANUFACTURE OF POTATO FLOUR IN EUROPE.

Germany.

(From Consul-General A. M. Thackara, Berlin.)

October 21, 1911.

The great bulk of the so-called potato flour (kartoffelmehl) that is sold at retail in the groceries of Germany for cooking purposes is simply finely ground and sifted potato starch. There is, however, a flour obtained by grinding and boiling dried potatoes that is a comparatively new product.

In 1901, when the potato crop of the country reached the enormous total of 53,682,010 short tons, efforts were made to discover practical and economical methods of preserving the potatoes, so that the surplus

could be stored and utilized in supplying future demands. Prizes were offered and a number of processes were submitted, in the more important of which the potatoes are dried by steam, forming what are called "kartoffelflocken," or potato flakes, which can be used for feeding stock, for distilling alcohol, for making starch, and for other purposes for which potatoes are used, or they can be ground and bolted for human consumption.

In the Tatosin process for the production of flakes, the raw potatoes are washed in a washing machine commonly used in distilleries or starch factories, and then conveyed by an elevator to a steamer erected over the drying apparatus, where they are cooked by means of low-pressure steam, as if the potatoes were to be used for feeding stock. The drying apparatus proper consists of two smooth hollow cast-iron revolving drums about 4 feet long and 2 feet in diameter, each with a clearance of about 0.039 inch. The drums are supported upon a cast-iron framework, on the top of which there is an iron hopper fitted at the bottom with emasculators, or crushers. The drums are heated by steam of 5.5 to 6 atmospheres led through a pipe passing through their axes. The interiors of the drums are ridged longitudinally. Condensed water is taken from the drums by two small pipes and returned to the boilers.

The potatoes after being steamed are allowed to fall by gravity into the hoppers and through the emasculators, where they are reduced to pulp, and in this shape are forced on to the drying drum. The drums turn in opposite directions at five revolutions a minute. The heat drives off the moisture of the potato pulp, leaving a firm mass that is scraped off by means of knives set parallel to the main axes of the drums. The dried mass falls into a spiral transporter fitted with revolving arms, where it is broken into flakes and conveyed to the packing room.

STATISTICS—GROUND POTATO FLOUR.

In other processes of preserving potatoes used in Germany the tubers are cut into disks or small pieces and dried by hot air. The method described, however, is that most in use. At present there are 436 plants established in Germany for drying potatoes, with an estimated production annually of 110,230 to 165,345 short tons, or 3,674,000 to 5,511,500 bushels. Of the above plants, 350 are for the production of potato flakes and in 86 plants the potatoes are dried by the hot-air processes.

The prices of potato flakes vary from 14 to 16 pfennigs (3.3 to 3.8 cents) per kilo (2.2 pounds.) The estimated cost of the production of the flakes is 6.30 marks ($1.50) per 50 kilos (110.2 pounds.

In the production of ground potato flour the potato flakes are ground and bolted. There are but few concerns that manufacture the flour, each having its own process. The flour is a yellowish white product, rich in carbohydrates. According to experiments made by the "Institut fur Garungs-Gewerbe" (Institute for the Fermentation Industry) in Berlin, the principal constituents of the flour are: Water, 10.69 per cent; protein, 6.59 per cent; fatty substances, 0.23 per cent; non-nitrogenous substances, 78.73 per cent; raw fiber, 1.1 per cent; and ashes, 2.58 per cent.

The flour is used principally by bakers for adding to rye and wheat flour in making bread. The proportion for wheat bread is 5 to 10 per

cent of the ground potato flour, and for rye bread the amount can be increased to 15 per cent. It is claimed that the addition of the ground potato flour to the rye or wheat flour gives the bread a good flavor, makes it more digestible, and keeps it fresh for a comparatively long time. It is also used to a slight extent in thickening soups and sauces.

There are no statistics available that would indicate the annual consumption of ground potato flour in Germany, but as an industry the manufacture of the flour has not attained large proportions. It is sold principally to bakers. It is known to the trade as "Walzmehl," "Kartoffel Walzmehl," "Patent Walzmehl" and "Fiddichower Walzmehl." The prices vary according to the potato crop and the quality, and range from $4.76 to $7.14 per 100 kilos (220.46) pounds).

(Circulars describing the Tatosin system of potato-flake manufacture in Germany, and containing pictures of the apparatus used have been forwarded by Consul-General Thackara and may be obtained from the Bureau of Manufactures.)

NETHERLANDS.

(From Vice-Consul Dirk P. De Young, Amsterdam.)

During the last 60 years potato farming has assumed large proportions in the Netherlands, due in great measure to the development of the potato-flour industry. In 1860 the total potato area was 273,318 acres, while in 1908 there were 395,089 acres. The following table shows the production by provinces in 1908 and the area of land devoted to the industry:

Provinces.	Production. Bushels.	Area. Acres.	Percentage of tillable area.
Drenthe	13,567,634	40,515	34.7
Friesland	12,459,213	40,192	38.1
Gelderland	11,729,464	65,609	22.6
Groningen	18,365,776	48,815	15.1
Limburg	4,960,600	30,562	13.7
North Brabant	9,634,745	55,784	15.2
	2,456,606	11,209	11.4
North Holland	9,959,664	40,031	34.7
Overyssel	6,294,550	26,497	18.0
South Holland	1,676,857	7,853	19.7
Utrecht	6,093,868	28,022	11.3
Zeeland			
Total	96,708,977	395,089	

Seventy-four per cent of the potato crop is used for food and seed and the remainder supplies the raw material for manufacturing purposes. Three-fourths of the manufacturing is done in the Province of Groningen, and the remainder is confined to three other provinces. Of the 48,815 acres of potatoes in Groningen over 37,000 were planted for industrial purposes.

USE OF FERTILIZERS—METHODS OF GATHERING POTATOES.

The scientific fertilization of the soil has become a very important feature of the potato industry in Groningen. Sometimes $32 to $50

worth of fertilizer is scattered on one hectare (2.471 acres) of ground. The land is valued at fully $500 per acre and rents at $22.50 per acre per year. The fertilizers consist of about 200 kilos of Chile saltpeter and 700 kilos of superphosphates to the hectare. Potatoes raised on this highly fertilized soil are not very edible, being cultivated principally for their industrial properties. There is a sentiment in favor of using the factory waste for fertilizing, but it has not proved a success as yet.

The methods of planting, cultivating and harvesting potatoes have not advanced as they should. Several picking machines have been tried of late, but not to the satisfaction of the planters. They want a machine that will not only dig the potatoes out of the ground, but clean off the dirt and empty them into a sack as well. A potato digger that merely uproots the potatoes, leaving them scattered over the ground to be picked up and sacked by hand saves little labor, as they still have to be cleaned, sacked and often shaken loose from the roots and vines.

In the co-operative potato producing and manufacturing enterprises the picking is usually let to contractors at from $0.09 to $0.10 per row of 140 meters (459 feet). That includes stacking them in piles and covering them with straw. The laborers are also given free potatoes during the picking season. Sometimes these contractors are the heads of large families, but there are also contractors who sublet to individual workmen. They usually pay the pickers $0.06 per row. One person is able to pick seven of these rows per day of seven hours. The whole family usually joins in the work, camping out on the potato field during the season. Independent farmers often pick their own crops.

THE CO-OPERATIVE SYSTEM.

A great impetus to the potato-flour industry was given by the co-operative method introduced during the last two decades. In fact the introduction of that system has really joined the operation of producing raw materials and manufacturing them into potato-flour. It led to the establishment of co-operative experiment stations whose object it is to study the scientific culture and treatment of potatoes for industrial purposes in all practical phases of the industry. Previously there was no organization between planter and manufacturer, which frequently proved disastrous to both.

The first step toward organization was taken in 1890 by several of the large manufacturers, but arrangements were not completed until 1900, owing to the lateness of some in joining. The factories then announced uniform prices for raw potatoes and the farmers had to sell on their terms. The latter retaliated by organizing co-operative producing societies, which soon developed into manufacturing institutions as well. There are therefore two systems of operating, one in which the farmers co-operate to the extent of owning shares in the factory, and the other in which the trading is independent and speculative.

The different co-operative plants are, of course, still competitive in respect to each other. They have their own trademarks, they sell independently through domestic and foreign agents, and are keen rivals in the production of superior qualities. Of the 34 potato-flour factories in the Veenkolonien, 11 are co-operative. The largest independent factory has a capital of $600,000 and the buildings and machinery are valued at $100,000. This factory has small branches in various sections of Groningen. Some of these mills have a capacity for grinding over 28,000 bushels in 24 hours; the smallest, about one-fourth of that amount. Three-fifths of the total production of potato-flour of the country is ground in independent mills. The demand for Dutch potato-flour is always greater than the supply.

THE MANUFACTURING SEASON—COST OF RAW MATERIAL.

The season for manufacturing potato-flour is usually about 10 weeks in duration—from the middle of September to the last of November. The fine waterway system of Groingen greatly expedites the delivery of potatoes, naturally shortening the season, and in fact accelerating the industry. The great network of canals and other waterways makes it possible to transport the potatoes directly from the field to the factory, the latter always being on canals that accommodate 40 to 100 ton vessels. Potatoes are sent in shiploads of 2,000 to 3,000 bushels each. Frequently, these ships are owned by the factories, though sometimes by private individual or transportation companies.

It is difficult to set an exact value on the potatoes used in the potato-flour industry. Some factories buy them by the hectoliter (2.837 bushels) without paying any attention to the quality, while others grade them according to the amount of starch contained. However, it is estimated that at an average of $0.34 per hectoilter the value of potatoes ground into flour in one season would be $3,400,000. Calculating roughly, 1 hectoliter of potatoes produces 11 kilos of flour (8.54 pounds to the bushel). A conservative estimate of the total production of potato-flour in the Netherlands for one season is 110,000 metric tons of 2,204.6 pounds. The price per bag of 100 kilos (220.46 pounds) has varied in the last few years from $3.60 to $5.20. An average price of $4.40 per bag would bring the total value of the manufactured product up to $4,840,000 per season, $1,440,000 more than the cost of the raw potatoes.

It would seem bad business for farmers to pay a rent of $22.50 per acre, fertilize to the extent of $10 or $15, and sell 380 bushels of potatoes per acre at $0.12 to $0.15 per bushel, but it should be understood that the most valuable land, highly fertilized, produces much more than the average.

EXPORTS AND DESTINATION.

The potato-flour exported from the Netherlands goes to Great Britain, Spain, Belgium, Italy, the free port of Hamburg, Denmark, and the United States and Canada. The United States imported $38,000 worth of dextrine and potato-flour from the Netherlands in 1910. England and Belgium are perhaps the best customers. Exports have grown from 35,933 metric tons in 1898 to 64,000 tons in 1909.

NUMBER OF FACTORIES—PROBLEM OF WASTE.

There are altogether 32 potato-flour factories in the Netherlands of which 24 are in the Province of Groningen, 2 in Friesland, 4 in Drenthe, and 2 in Overyssel. In addition to this there are several small factories producing only dextrine or glucose. The total number of men employed

in the works is nearly 3,000. Most of the factories are situated on deep canals in the reclaimed swamps of the Veenkolonien, and the tubers are transferred from the boats direct to the mill.

A disagreeable feature of the potato-flour industry in the Veenkolonien is the waste thrown off and the subsequent pollution of the canal water. Just after the milling season the water is so bad that ignitible gases evaporate from it. Often a lighted match thrown into the canal will cause an apparent blaze. The economic loss resulting from this waste is in the eyes of the planters of that region a serious matter. In all it is estimated that the wasted material is worth $666,432 per year.

THE MANUFACTURE OF DEXTINE AND GLUCOSE.

In connection with the potato-flour industry there are seven dextrine factories in the northern part of the country and two in the Province of Limburg. Dextrine is used chiefly for sizing purposes in textile plants. As a consequence, the demand for that product depends largely upon the cotton and linen industries. While there is a flourishing cotton industry in Overyssel, it is not sufficient to consume all the dextrine produced here, the remainder being shipped to Great Britain, United States, Spain, Italy and Belgium. However, the exports in this line have decreased of late years, owing to both the increased price of the dextrine and higher import duties in many foreign countries.

The production of glucose from potatoes in the Netherlands dates from 1875, since which time it has not only greatly increased but the quality has been improved. Eleven factories, some combined with potato-flour establishments and others working independently, produce glucose from potatoes in both the solid and liquid state. From a total production of 9,600 metric tons in 1896 it has grown to 20,000 tons in 1908. Almost all of this glucose is consumed in the Netherlands, especially in confectionaries and cake and jam factories. It is impossible to build up an export trade in this article, owing to the high import duties in other countries and the strong competition it encounters especially from American glucose manufactured from corn. There is a constant fear of overproduction in this article. However, the confectionary industry in the Netherlands is so thriving that domestic consumption may keep pace with the supply for a long time. The high excise tax on the article when consumed in the country—3.28 cents per pound, American currency—is a great bar to its use. The form in which it will find its most successful outlet, therefore, is in a manufactured state, such as cookies, candies, and other confectionaries, as the excise is withdrawn from such articles if actually exported to another country. It is evidently exported in that form.

In concluding this report I would say:

First, That the Michigan potato is a valuable asset and contains food values that would warrant its being dried and manufactured into flour;

Second, That it is feasible to use the dryers at present used in the Michigan beet sugar and chicory factories for the drying of potatoes, if hard coal is used;

Third, That the demand for dried potatoes and potato flour would be sufficient to warrant the factories in utilizing their dryers for this purpose;

Fourth, It seems that this can be done and a fair price paid to the farmer;

Fifth, The food stuffs with which dried potatoes would have to compete in order to be used in very large quantities are beans and wheat flour.

I am somewhat surprised that a State like Michigan, which stands in the fore ranks as a producer of potatoes, has not given some attention both to the drying of potatoes and the development of a market for this product. Our whole effort seems to have been along the line of a greater production, which in one way is very commendable, but which on the other hand is very disastrous unless provision is made for the utilization of this larger production.

I hope I may be excused for the digression if I say a few words on the grading and marketing situation in the Wolverine State. As far as potatoes, apples and some other things are concerned, the absence of any organization for their grading, and of adequate facilities for their marketing, might almost be termed criminal. We do not seem to realize that there should be no over-production, when there are thousands of people in this country who do not know where they are going to get their dinner today nor their breakfast tomorrow morning. A situation that will permit a waste of $2,000,000 worth of a valuable food stuff, such as potatoes in this State, while thousands of people are hungry and other thousands are paying a high price for the product, is not a desirable one.

A larger production does not in all cases mean an increase of wealth in the community. It is a loss unless proper provisions are made whereby this larger production can be turned to the profit of the producer. If, on our $10,000,000 potato crop this year the farmer will suffer a loss of $2,000,000 on account of lack of a market, on twice this production, or a $20,000,000 crop the farmer would have a loss of $12,000,000, and on a $30,000,000 crop he would have a loss of $22,000,000.

Some adequate arrangement should be made in regard to the marketing of farm products, or a larger production in our rural districts will mean a loss to those districts instead of a gain.

Another matter that should receive attention is that of grading apples, potatoes, and other farm products. The present system of selling apples in what is known as "orchard run," or potatoes as "field run," settles no one's problem. It is a waste to the consumer who desires only first class varieties, and a loss to the consumer whose financial condition is such as to make it advisable for him to buy an article at less cost that would serve his purpose as well.

I think the people of Michigan could learn much in the way of grading and marketing from the fruit growers of the west, who put their products in packages so that every purchaser will know in advance exactly what he is buying. Even the man with the little fruit stand on the corner knows in advance how many apples there are in the box packed under regulations in one of the Western States, and consequently can plan in advance how many apples he can sell for ten cents in order to make the desired profit.

I doubt if any other business in the State would continue long with as little attention paid to grading and marketing as has been paid to the fruit and potato crops. If a shingle manufacturer should put into one package his culls, sound butts, six-inch clear butts, and XXXX shingles,

he would not be able to find a market in the United States for his product, and if he did find one it would be practically at the current price of the lowest grade shingle in the package, which would be the culls. How long would a manufacturer of lumber be able to do business if all grades were put together and the man who wanted a carload of fine common was required to purchase half a carload of shipping culls, mill culls and scoots, for which he would have no use and which would be a waste as far as he was concerned? On the other hand, how would the purchaser be benefitted who wanted a carload of shipping culls, which would answer the purpose for which he wanted them as well as the better grades, if he had to pay an additional price because a third of the carload was composed of fine common and better?

Michigan is a great State. She stands well in the fore ranks as a producer of agricultural products. Her apples are the best grown in the world. The quality of her potatoes is equalled by only one or two States. The future along potato and fruit lines is wonderful if we only solve the grading and marketing proposition. This can be done at but very little expense to the State of Michigan. All it requires is doing, and somebody to do it.

Returning to the subject under investigation, it would seem that the handling of the potato crop by the dryers now in existence would not be impracticable, as the machinery necessary to prepare the potato for the dryer would be somewhat inexpensive, due to the fact that the potato can be sliced and dried without peeling. When it is dried it is ground into flour, the flour bolted through fine cloth, the same as wheat flour, and the peelings are separated from the flour, just as bran is separated from wheat flour. Once potato flour is placed on the market in suitable packages, I am sure the Michigan housewife, as well as housewives all over the United States, will be as desirous of using this product as the imported article from European countries.

In making plans for the drying of potatoes and the manufacturing of the same into flour, let me say that we should plan on operating the factories every year. All potatoes should be graded and all the smaller ones should be shipped to the dryers. This would leave the farmer with a high grade of potatoes to place on the market, and in all probability he would get more for his crop with the smaller potatoes absent. If we had had in operation in Michigan last fall dryers that could have utilized the smaller potatoes, we would not have a surplus on hand today. If from a potato crop valued at $10,000,000 we have a $2,000,000 surplus, it means that one-fifth of our crop can find no market. Now, if these potatoes had been graded and the one-fifth of small potatoes sent to the dryers there would have been no surplus in Michigan.

I would recommend that this whole matter be turned over to the State Board of Agriculture with full power to act. I would also recommend that an appropriation of $5,000 be made to be used in investigation, and experimental purposes if necessary. If the appropriation made by the present Legislature is sufficient, I would suggest that this $5,000 come out of the mill tax going to the Agricultural College; if it is not large enough I recommend that a special appropriation be made.

The State Board of Agricuture is made up of good business men, and one of the members has control of several pulp dryers, utilized in the

drying of pulp from sugar beets. He is an energetic, forcible gentleman who has given some study to the proposition of drying potatoes, and says that the pulp dryers of this State can be utilized for this purpose. If this gentleman can not solve the problem of drying and manufacturing potatoes into flour, especially the surplus crop of this year and other years to come, I know of no man in Michigan who is able to do it.

The solving of the problem of utilizing the potato crop in Michigan would mean millions to the State. We could increase our potato production, under favorable conditions, to $20,000,000. This great amount of money, which would represent an increase in the purchasing power of the rural communities, would eventually find its way into the trade channels of the country, through the purchase of the manufactured articles of the city.

The solving of these problems affecting agricultural prosperity today is one of the big things and is worth the attention of the big man. No individual can render a more valuable service to the State than to be instrumental in working out this problem along such lines as will accrue to the benefit of both the producer and consumer.

All of which is respectfully submitted,

AUGUSTUS C. CARTON,
Secretary, Public Domain Commission.

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TITLE